

DIP #610

Imaging and The USMLEs (Part 1)

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- **Dr Mohammed Zaki**

<https://chat.whatsapp.com/L6dShASc3f97cwHZgCD6Xo>

BREAST: MAMMOGRAPHY, USG, MRI

Introduction & Breast Imaging

- Welcome to **Episode 610** of the **Divine Intervention Podcasts**.
- In this podcast, we're going to be addressing a very **high-yield** topic that I title **Imaging and the USMLE**.
- The goal of this podcast is to provide a range of **scenarios** for specific things you may see on your **exams**.
- I've gotten a lot of questions from people on this, and I've decided to make a podcast on it.
- Honestly, this is very likely going to be a **series**, and this is one of those things that are kind of difficult to prepare for.
- In fact, these are my best efforts to expose you to different things, and it's like, OK, where would I make this decision on the **USMLE** exams?
- This is one of those things that you either **know or you don't know**.
- There's not much in the way of **testing principles** that can get you to this.
- So let's get right into it.

Scenario: Screening in a 42-Year-Old Woman

- What if they give you a question about a **lady that is 42 years old**, and she comes for her **primary care visit**, and you're told:
 - "Which of the following **screening modalities** or **screening procedures** is recommended for this patient?"
- I would really hope you're saying that this is going to be a **mammogram**.
- Remember, **mammography** on the **USMLE exams** is going to be done for women that are **over the age of 40**.
 - You're going to do it **roughly every year or two** as a means of screening for **breast cancer**.
- Now, the **USMLE**—they're not stupid.
 - So sometimes, instead of calling it **mammography** on the exams, they may call it **breast radiography**.
 - They may literally call it **X-ray imaging of the breast**.
- Just remember: **literally**, mammography is taking an **X-ray of the breast**.
 - That's literally what it is.
- Again, **do not forget**: we **start at age 40**.
 - I know some people will tell me that **USPSTF said this and blah blah blah**.
- For the **USMLE exams**, this is **Divine speaking in June of 2025**:
 - You want to start at **age 40**.

Evaluating Breast Masses by Age

- Since we're talking about **breast imaging**:
 - How do we evaluate **breast masses** in **women under age 30**?
 - Hope you're saying that it's an **ultrasound**.
 - So if a woman is **under age 30**, you want to use an **ultrasound**.
 - What if a woman is **over age 30**?
 - You want to use a **mammogram**.
 - Our friends at the **NBME** can actually create a **biostatistics** question from this factoid.
 - They might say:
 - A 25-year-old female has a **breast mass** and is getting a **breast ultrasound**.
 - Then they ask:
 - “Which of the following is the most likely **reasoning** or **thought process** behind choosing this imaging modality in this patient population?”
 - I would really hope you're saying that compared to **mammography**, it has a better **sensitivity** or **better negative predictive value** in this population.
 - Or they may ask:
 - “Which of the following factors makes the physician **not pick mammography** as the modality in this 25-year-old female?”
 - Well, it's because **mammography** in younger females (**under age 30**) has a **reduced sensitivity**.
 - It is **not as sensitive**.
 - Because it's **not as sensitive**, it has a **very low negative predictive value**.
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Key Diagnostic Concept: Sensitivity and Predictive Value

- Please make sure you understand this:
 - Whenever a test is **not very sensitive**, it means that the test is **poor at catching people who are sick**.
 - If a test is poor at catching people who are sick, then **negative results from that test are not reliable**.
 - So the test has a **low negative predictive value**.
- That's why we choose **ultrasonography** in women **under age 30**—because compared to **mammography** in this population:
 - It has **better sensitivity**.
 - It has **better negative predictive value**.
- Remember, a woman under age 30 likely has **denser breast tissue**.
- But if she is **over 30**, we're going to evaluate that **breast mass** with a **mammogram**.

Breast Discharge & Special Mammography Scenarios

- What if they give you a scenario about a **lady**, and you are told that she has, for the last couple of days, noticed this **reddish discharge** from her **left breast**?
 - Well, obviously, that's going to be an **intraductal papilloma**.
 - What do you do in that situation on your exams?
 - Go ahead and get a **mammogram**.
 - Again, that's **another indication** for **mammography** on the **USMLE** exams.
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Bizarre but Common Scenario: Negative Mammogram but Still a Mass

- Now, there is one **bizarre scenario** that is now showing up more and more frequently on the exams.
 - They can give you a question about an **individual**, a **lady** that has a **breast mass**, and you're told:
 - “Oh, she got a **mammogram** like 3 months ago or 4 months ago, and it was unremarkable.”
 - What should be your **next step** on your test?
 - Your next step should be to get an **ultrasound**.
 - They love to do this to people.
 - Many times, the lady that has this issue will be somebody **over age 30**.
 - Because they're trying to see if you'll say:
 - “Oh, let me go back and pick mammography again.”
 - **No**. If you've had **mammography** within the last few months and you need to evaluate a **breast mass**,
 - Please **do not** do **mammography** again.
 - **Get an ultrasound—even if the lady is over age 30**.
 - This is **extremely important** to know for your exams.
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When Breast MRI is the Right Answer

- Another classic situation you may see on your exams is they may give you scenarios where **breast MRI** is the right answer.
- So, what are some situations on your exams where **breast MRI** may be the right answer?
- The **big, big, big one to know** is to use it to **screen people that are at higher risk for breast cancer**.
- If a person has a **high risk for breast cancer**, and you see the words "**high risk**" with "**breast**", think:
 - A person that has some kind of **genetic syndrome** that predisposes to breast cancer, like the **BRCA mutation**.

BRCA Screening Timeline

- People who have **BRCA mutations**, when do they start **breast cancer screening**?
- They start at **age 25**.
- Remember: starting at **age 25**, they get **Annual Breast MRIs**, and then...
- Between the ages of 25–30, they do that **until age 30**.
- But once they hit **age 30**, they begin to have **mammograms added** to that.
- That's something that's **pretty high-yield** to know for your exams.
- So to repeat:
 - From **age 25 to 30** → just **breast MRI**.
 - Starting at **age 30** → **breast MRI + mammogram** annually.
- So again, don't forget:
 - **Breast MRI** → people that are **high risk** for some **genetic cancer syndrome**.

Palpable Mass with Negative Imaging? Still Biopsy

- What if they give you a question about a **patient**, and you're told:
 - "This patient is a **45-year-old female**, and she came in with a **palpable breast mass**."
 - She came in with this **mass** in the **upper outer quadrant** of the breast.
 - You're told that **mammographic evaluation was done** and it **failed to show any lesions**.
- Then they ask you:
 - "What is your next best step?"
- Your next best step on the exam should be to **go ahead and get a biopsy**.
- **Go ahead and get a biopsy**.
- This is **super high-yield** to know for your exams:
 - If a person has a **palpable breast mass**, even if the imaging is **negative**—typically a **negative mammogram**—**go ahead and proceed to a biopsy** of that mass

Differentiating Malignant vs Benign Breast Lesions on Imaging

- One other thing I think I want to say about **breast** is:
 - **Differentiating a malignant breast lesion** from a **benign breast lesion**.
 - Because the thing is, sometimes our friends at the **NBME**, they will give you **characteristics** of something.
 - Then based on those characteristics, you will notice that they end up putting **some of those characteristics** as **answer choices**.
 - And then they want you to try to decipher:
 - OK, based on this, will this characteristic push us more towards **considering this thing as a benign lesion** or **considering this thing as a malignant lesion**?
 - Early in the **question stem**, let's say they are describing a **breast mass on mammographic imaging**.
 - They'll give you like **5 characteristics** of the breast mass.
 - And then, of those characteristics, they'll put **5 of them** as **answer choices**, and they want you to:
 - Pick **one** of them as the thing that **tips you toward benign vs malignant**.
-

Malignant Features on Imaging

So what are some things you'll see on imaging that will tell you that this breast mass is probably **malignant**?

- If, for example:
 - The **mass is irregular**
 - The mass has **spiculated margins**
 - The mass is **radiodense** (a radiodense mass is more worrisome for malignancy than a radiolucent mass)
- I like to use this term: a "**varying mass**".
 - You may wonder: Divine, what in the world do you mean by a varying mass?
- Let me give you an example:
 - Many of us know that in **melanomas**, one of the things we worry about is if the person has a mass that just has **different colors**.
 - If it has like one color, we're probably less worried.
 - But if it has **color variations**, that's **super worrisome**.
- So if you have a **breast mass** that is:
 - Irregular
 - Has **multiple shapes fused together**
 - One side is one size, another side is another size
 - That is more likely to be a **malignancy**

Worrisome Breast Calcification Patterns

- One other thing to keep in mind—especially with **calcifications** in the breast—is that if they use **any of these four terms**, you should be worried:
 - **Linear** calcifications
 - **Coarse** calcifications
 - **Segmented** calcifications
 - **Clustered** calcifications
 - That is **highly, highly worrisome** for **malignancy**.
 - I'm going to say that again:
If you have a **breast mass** on the **USMLE exams** that is described as having:
 - **Linear, coarse, segmented, or clustered calcifications**
→ those are very, very **worrisome for malignancy**.
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Benign Features on Imaging

Now let's look at it from the flip side.

What are some things you may see on **mammographic imaging** that suggest the lesion is likely **benign**?

- If the lesion is:
 - **Round or oval**
 - **Well circumscribed**
 - **Well defined**
→ that's **less likely** to be malignant.¹
 - If the lesion is **radiolucent**—that is **very high-yield**.
 - Many times, if something is **radiolucent**, it either contains **oil** or **fat**.
 - For example:
 - An **oil cyst** in the breast
 - A **lipoma** (a small fat mass)
 - **Galactoceles** (milk retention cyst)
- On **mammographic imaging**, they tend to be **radiolucent**
-

Benign Calcification Patterns

What kind of **calcification pattern** tells us the lesion is probably **benign**?

- Remember, for **malignancy**:
 - **Linear, coarse, segmented, clustered**
 - But for **benign**:
 - **Popcorn calcification**
 - **Layering calcification**
 - Like **teacup orientation** or **crescent-shaped** → that's called **milk of calcium**
 - It's a **super benign** breast finding
 - Or:
 - **Calcification in a vascular pattern**
→ So it's outlining the **path of a blood vessel**
 - Also:
 - **Scattered calcifications**
→ Not linear or segmented → more likely to be **benign**
 - It's almost counterintuitive, but it actually makes sense if you think about it:
 - If a **calcification** is **scattered**, it's less likely to be some kind of **coherent mass**
 - So it's **less likely to be malignant**
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Bonus: Popcorn Calcification Outside the Breast

- Since I'm talking about this concept of **popcorn calcifications**, where else do we see that?
- I'd really hope you're saying:
 - Oh Divine, in the **lung**.
- If a person has a **lung mass**, or if a person has **calcifications in the lungs**, and you see that it has this **popcorn orientation**,
 - That mass is almost certainly a **pulmonary hamartoma**.
- A **pulmonary hamartoma** is a **very, very high-yield association** to know for your exams.
- See, to be honest with you, these things are things that you either **know or you don't know**.
- It's almost like learning **risk factors** or **prognostic factors**.
- So please just make sure you know this stuff for your exams.

CLABSI

Endocarditis + No Antibiotic Option

- What if they give you a question about a **patient**, and they tell you:
 - This patient **presented with shortness of breath, chest pain**, and during the person's hospitalization, they did a **blood culture** that grew **gram-positive cocci in clusters**.
 - **Echocardiographic imaging** of the person's chest disclosed **vegetations on the tricuspid valve**.
 - And then you are asked:
 - "Which of the following is the most appropriate **next step in management?**"
 - The thing is, you notice on your exams that they **don't provide any antibiotic answers**, so you're like:
 - That's weird—this person has **endocarditis**, why are they not giving me an answer that involves **giving antibiotics?**
 - Then you notice that in the **answer choices**, they provide a series of **procedures or interventions**.
 - I will **strongly encourage you** to pick the answer choice that talks about:
 - **Insertion of a central venous catheter**
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Central Venous Catheter = Central Line

- What's a **central venous catheter**?
 - A **central venous catheter** is what many of us know as a **central line**.
 - Many times, it's going to be inserted in a **vein**.
 - You can have a **femoral central line**.
 - You can have a **jugular vein central line**.
 - You can have a **sub-clavian central line**
 - Although we try to avoid the **femoral** site because that's a **very dirty area**—your **groin area**—it probably has the **highest risk** of a **central line-associated bloodstream infection (CLABSI)**.

Why Insert a Central Line?

- So why are we inserting a **central venous catheter** for this person?
 - Because the person is going to be getting **antibiotics for a long time**.
 - Whenever a person is going to be getting **long-range antibiotics**—many times for **6 weeks**, for example—you typically want to give those antibiotics through **some kind of central line**.
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Common Infections Requiring Central Lines

What are the **classic infections** we do this for?

- **Endocarditis**
 - **Osteomyelitis (a bone infection)**
 - These patients tend to require **central lines** because they're getting antibiotics for a **really long time**.
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Other Indications for Central Line on USMLE

What are some **other indications** on the **USMLE** for a **central line**?

- If a person is getting **chemotherapy** → they need a **central line**.
 - If a person is getting **TPN (Total Parenteral Nutrition)** → must be given through a **central line**.
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Most Common Complication of TPN

- What is the **most common complication** of **TPN administration**?
 - I really hope you're saying:
 - “Oh Divine, it's a **central line-associated bloodstream infection**.”
 - Why is that?
 - Think about it logically.
 - You're literally **putting food down a vein**.
 - Do you really think you're the only one who wants that food?
 - **Bacteria** also want that food.
 - So the **most common complication**—this is **very, very high-yield**—is:
 - **Central line infection**
-

Don't Be Fooled

- They'll try to confuse you and put **acalculous cholecystitis**.
- Do **not** pick **acalculous cholecystitis** if **central line-associated bloodstream infection** is a provided answer.
- **Make sure you know that.**
- A person is getting chemo, TPN, Antibiotics for a long-term infection – think of central venous catheter.

Signs of Central Line Infection

- If a person has a **central line**, and now has:
 - A **fever**
 - **Severe pain** at the **insertion site**
 - **Leukocytosis**
- That's a **central line infection**.
- What do you do?
 - You get a **culture from the central line**.
 - And you get a **culture from a peripheral vein** somewhere else in the body.
- **Very high-yield**. Know that stuff for your exams.

Thrombosis of a Central Line

- They can even give you a question where they tell you:
 - A **patient has a central line placed**.
 - The person starts having **very severe pain** at the **central line insertion site**.
 - You perform **ultrasonography**, and you notice there is **no flow within the vessel** that the line has been placed into.
 - For example:
 - Let's say you have a **jugular central line**, and the person starts having **neck pain**.
 - You're told that **ultrasonography fails to disclose vascular flow** in the **jugular vein**.
- In that case, what do you want to think about?
 - You want to think about a **thrombosis**.
 - The person has literally **thrombosed** that **jugular venous central line**.
- **Keep that at the back of your mind** for your exams.
 - That's a **very high-yield** presentation to know.
 - So don't forget that central lines can become infected, central lines can become thrombosed.
 - When you see the terms absence of flow, especially in the line, especially in the central line, think of a central line thromboses.

IVC FILTER / TPA / EMOBOLECTOMY / EMOBLIZATION

DVT with Contraindication to Anticoagulation

- What if they give you a question about a **patient**, and they tell you:
 - This patient came into the **emergency room** and has had, for the last 12 hours, **very significant pain** in the **right lower extremity**.
 - Their **temperature is 100.5°F**, and you're told that **one leg is bigger than the other**.
 - The person has just taken some kind of **plane ride** or a **long car ride**.
- Obviously, you're thinking about a **DVT**.
- Then they tell you that **12 days ago**, the patient was treated for a **very significant GI bleed** where he was **hemodynamically unstable**.
- Then they ask:
 - "Which of the following is the most appropriate **next best step in management**?"
- I would really hope you're picking the answer that involves:
 - **Placing an IVC filter (inferior vena cava filter)**

When Not to Anticoagulate: Go IVC Filter

- This is **very high-yield** to know for your exams:
 - If they give you a question about a person that has a **DVT**, and the person has some kind of **contraindication to anticoagulation**...
 - Let's say they've had **recent major hemorrhage**, or **ongoing really bad bleeding**...
- In those circumstances, I would **strongly encourage you** to pick the answer that involves placing an **IVC filter**.

When to Do Embolectomy on the Exam

- Another question I get with **vascular things** on your exam is:
 - "When should you do an **embolectomy** on your test?"
- **Embolectomy**—sometimes—is the right answer.
- Basically, **bringing out an embolus from a vessel** is the right answer in **certain very specific situations** on your exams.

Situations Where Embolectomy Is Correct:

1. Saddle Pulmonary Embolism

- If a person has a **PE**, and it's a **saddle embolus**, in those circumstances, you absolutely should **do an embolectomy**.
- I would **not** pick **TPA** for that person.
- It's a **big, big, big lesion**—if we do nothing, they could **die quickly**.

2. Acute Limb Ischemia

- If they give you a person that has a **history of Afib** or recent **MI**, and then they have:
 - **Sudden onset severe lower extremity pain**
 - And **all arterial pulses** in that extremity have **disappeared**
- That's **acute limb ischemia**.
- In those circumstances, you need to do an **embolectomy**.

Embolectomy ≠ Embolization

- Another situation students confuse is **embolectomy vs embolization**.
- **Embolization** is **not** the same thing.
 - **Embolization** is where you **directly induce an embolus** in a vessel—typically to **stop bleeding**.
 - Many times on the **USMLE**, they're going to do this through **angiography**.

When to Use Embolization:

- **Interventional radiology** procedure → when a person has a **really nasty GI hemorrhage**.
 - If the person is **very unstable**, and they're bleeding from:
 - A **mesenteric vessel**,
 - A **hematoma**,
 - Or **some source you can't surgically fix right away...**
- That person **needs angiography with embolization**.

When to Use TPA

- Now what are some situations where we use **TPA** on the exams?
- They might call it:
 - **Streptokinase**,
 - **Urokinase**,
 - **Alteplase**,
 - **Tenecteplase**.

Use TPA in These Cases:

1. Ischemic Stroke

- The stroke must be **less than 4.5 hours old**.
- If so → **Give TPA**.

2. STEMI (MI)

- If the person is **more than 2 hours away** from a **PCI-capable facility**.
 - Then → **Give TPA**.
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Back to Acute Limb Ischemia: What If Embolectomy Isn't an Option?

- One weird scenario they might give you:
 - They give you an **acute limb ischemia** question, and **embolectomy is not listed** as an answer.
 - In that case, I would **strongly encourage you** to pick the answer that talks about **TPA**.
 - Remember:
 - The **management of acute limb ischemia** starts with **anticoagulation first**.
 - Then you do a **CT angiogram** of the lower extremities.
 - Then you do the **embolectomy**.
 - But if you don't see **embolectomy** as an answer, pick **TPA**.
 - You can absolutely use **TPA for acute limb ischemia** on your exams.
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Reperfusion Injury

- What if they give you a question about a **patient who got TPA hours ago**, and then you're told:
 - Over the last few hours, the patient started having **red urine**.
 - And they give you an **EKG** showing a **wide QRS complex, peaked T waves**.
 - You see the **creatinine is 2.5**.
 - When you see something like this, I really hope you're thinking:
 - **Reperfusion injury**
-

What Is Reperfusion Injury?

- When you **restore vascular flow** to part of the body that was **ischemic**, especially after a **delayed intervention**, you can get:
 - **Destruction of muscle**
 - **Hyperkalemia**
 - **Myoglobinuria (→ red urine)**
 - **Elevated creatinine**
 - **Renal failure**
 - Why?
 - Because **restoring blood + oxygen** generates **free radicals** that cause **tissue damage**.
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Treat Hyperkalemia from Reperfusion Injury

- If the person has **hyperkalemia**, and they're starting to have **EKG changes**, your next step is to:
 - Give **calcium gluconate**
- This helps **stabilize the myocardium**.